

# Green Computing & Major Issues of E-Waste in Modern Age

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**Abstract**— Green computing is a way of reduce global warming and hazardous waste products. In today's world, major issue is to achieve the efficient energy to minimize the electronic waste. In recent days, focus of IT companies and technology firm has been shifted towards green computing. As the number of electronic gadgets increasing day-by-day, so the amount of electricity consumed by them was too high. This in turn increases the toxic gases in atmosphere. Due to global warming various rules and regulation related to environmental facts forces manufactures of electronic equipment to meet various energy requirements. If the computer cannot be reused, should be recycled and the e-waste could be avoided. E-waste can be used for both recycling and refurbishing. This paper describes the issues of harmful impact to use of computers and to reduce energy consumption and save our natural resources.

**Key words:** Green Computing, Recycling, Refurbishing, Green IT, Eco-Friendly

## I. INTRODUCTION

Green Computing is practice of designing, manufacturing, using and disposing of computer server and associated sub system such as keyboards, CPU, printers, storage devices networking and communication system efficiently and effectively without impact on natural resources. The temperature of earth is increasing day by day. Due to toxic substances, which are produce by burning of electric equipment and hazardous waste product. The goals of green computing related to green chemistry. Which are to ease the use of hazardous materials, maximize energy effectiveness through the product's lifetime, and endorse the recyclability or biodegradability of nonoperational products and factory waste. IT departments of many companies are investing both time and money in green computing initiative to reduce the ecological impact of their IT operations. Green computing is a well-balanced and sustainable move towards the Achievement of a greener, improved and safer environment without compromising technical requirements of the current and upcoming invention. In 1992, the U.S. Environmental Protection Agency launched Energy Star, a voluntary labeling program that is designed to promote and identify energy-efficiency in monitors, climate control equipment, and other technologies. This resulted in the widespread adoption of sleep mode among consumer electronics. [1] This paper is a survey of several important literatures related to the field of green computing that importance of green computing for sustainable environment.

## II. LITERATURE VIEW

In this section, a survey of some very significant literature on green computing has been seen under the following subheadings:

### A. Environmental Impacts

When it comes to computer disposal, you need to know everything there is to know in order to be concerned in green computing. The completely green aspect came about quite a few years back when the news that the environment was not a renewable resource really hit home and people started realizing that they had to do their part to protect the environment [2]. The increasing emission of greenhouse gases is changing the world's climate and weather patterns in a frightening way. Electricity plays a vital role in increasing global temperature day by day. Because the thermal power plants that helps to generate electricity also releases huge amount of carbon dioxide and many other harmful gases into the atmosphere. These gases will causes for smog, acid rain, respiratory problem, climate change, increasing of sea level. Reducing the usage of electricity and producing the computing products in more eco-friendly manner is a key way to reduce toxic gases. Atmosphere pollution could be because of the defects in manufacturing techniques, packaging, disposal of computers and components. There are lethal chemicals used in the manufacturing of computers and when we use informal disposing, they put dangerous impacts on our environment. All these directly or indirectly increase carbon dioxide emissions and affect the environment. The total electrical energy consumption by servers, computers, monitors, data communication equipment, and cooling systems for data centers is also increasing at a very fast. These increase in energy consumption results in increased greenhouse gas emissions.

### B. Green It Rules & Regulation

#### 1) EPEAT: [Electronic Product Environmental Assesment Tool]

It is a tool for purchasers to estimate the effect of a product on the environment. It is managed by Green Electronics Council, a non-profit organization founded in 2005 to inspire and catalyze environmental leadership throughout the lifecycle of electronic technologies[3]. It evaluates electronic products based on 23 required criteria and 28 optional criteria which are additional regrouped into 8 performance categories such as reducing and eliminating environmentally sensitive materials, selecting materials, designing for the product's end of life (such as recycling), product longevity, energy conservation, end-of-life management, corporate performance, and packaging.[4] The bronze products meet every 23 necessary criteria. The silver products meet all required 23 criteria and in addition at least 14 optional criteria. The gold products should meet the 23 required criteria and in addition at least 21 optional criteria. Manufacturers may wish to choose to fulfill the 28 optional criteria to boost their Epeat score and achieve a privileged level of product categorization. Epeat recognizes numerous desktop computers, laptops and monitors from some of the primary manufacturers as green products. Some computer

contracts issued by major government agencies in the US with some private enterprises already refer Epeat.

#### 2) *Energy Star*

It is a trademarked international standard for energy efficient consumer products. Energy star products are manufactured because of less power consumptions. Energy star 4.0 version can be popularized in time of 2007. Later it can be upgraded to new versions namely called 5.0, 6.0 these power consumptions specifications are used for variety of products like television, refrigerators, computer, home appliances, heating and cooling system, imaging equipment, lighting etc.

#### 3) *W.E.E.E. Law*

The European Waste Electrical and Electronic Equipment Directive became law in 2003. It is a collection, recycling, reuse and recovery targets for all types of electrical goods. The symbol adopt by the European council to characterize waste electrical and equipment comprised a crossed out wheellie bin with or without a single black line underneath the symbol. The purpose of the directive is to decrease waste from electrical and electronic equipment and to offer incentive for conniving equipment that improves environmental performance throughout the lifecycle.

### III. E WASTE MANAGEMENT

Electronic goods manufacturing industries is the world's largest and innovative industry for its kind. Throughout the world, tons of electronic equipment are shipped over oceans, however, after their practice time which consists of hazardous heavy metals, toxic acids, non-degradable plastics.

#### A. *Sources of E-Waste*

Almost each used electronic equipment are considered as a e-waste. The source of e-waste products mostly from industries, school, hospitals, private sector, large concerns and from home used products. These are the main source for e-waste.

#### B. *Effect of Products from E-Waste in Human Health*

The effect of e-waste on human health reveals serious negative outcomes for those dismantling and handling components of discarded electronics. Computer wastes that are land filled produces polluted toxic materials. Which eventually pollute ground water level. Acids and sludge obtain from melting computer chips, if inclined on the soil causes acidification. Solder in printed circuit boards, glass panels and gaskets in computer monitor that are made up of lead (Pb) causes the damage to central and peripheral nervous systems, blood system and kidney damage. Hexavalent chromium (Cr) 6 are made in corrosion protection of untreated and galvanized steel plates, decorator or hardner from steel housings causes the asthmatic bronchitis and DNA damage for humans. Motherboard is made up of beryllium (Be) which affects the carcinogenic problem, inhalation of fumes and dust. PVC are mixes with cables and computer housing manufacturing. Burning of these substances causes reproductive and developmental problems, immune system damage and interfere with regulatory problem.

#### C. *Current Disposal Method of E-Waste*

##### 1) *ACID Bath*

It involves soaking of electronic circuits in the powerful sulphuric, hydrochloric or nitric acid solutions that free the metals from the electronic pathway. Acid bath also used to soften the lead and in the mining of gold and silver. The recovered metal is used in the manufacturing of further products though the hazardous acid waste finds its way in the local water resources.

##### 2) *Land Fills*

It is the most frequent methodology of e-waste clearance. Soil is excavated and trench are made for bury the e-waste in it. E-wastes ending up ad landfills are described as toxic time bomb [5]. They may discharge to the environment after a number of years by natural means, and there is a prospect of leaching of wastes such as batteries releases acids and heavy metals mercury, nickel and cadmium. These could reach the land water and reaches animals and humans, and mixes with further fresh water cause such as rivers and streams.

##### 3) *Incineration*

Incineration called as waste treatment technology, which includes the combustion of waste for recovering energy. During the process of incineration, the waste material that is treated is converted in to IBM, gases, particles and heat. These particles are later used for generation of electricity. It reduces the mass of waste from 95 % to 96%. When heating the plastic or PVC circuit board it releases erotic fume consists of polycyclic aromatics (PCA), polychlorinated dibenzo-para-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs) which are recognized carcinogens and gases such as carbon monoxide, sulfur dioxide, and nitrogen oxides. Smokes also consists of minor quantity of oxides of subsequent heavy metals residues antimony, lead, thallium, arsenic, copper, manganese, mercury and nickel, remainder ended up in the ashes.

#### D. *Management Technologies*

##### 1) *Responsibility of Government*

Government should be responsible for providing an enough system of laws, controls and organizational procedures for hazardous waste management. Government should promote and maintain NGOs and other organizations to occupy actively in solving the nation's e-waste problem. Uncontrolled dumping is an undesirable method for disposal of harmful waste and should be phased out. Government should explore opportunities to act as a group with manufacturers and retailers to supply recycling services. Government should set up dictatorial agencies in each district, which are vested with the steadiness of co-ordinating and consolidate the authoritarian function of the various government authorities about hazardous substances. Government should persuade research in to development and ordinary of hazardous waste management, environmental monitor and the instruction of hazardous waste disposal. Encourage beneficial reuse of "e-waste" and encouraging business activities that use waste. Educate e-waste generators on reuse options.

##### 2) *Responsibility of Industries*

Manufacturers, distributors, and retail dealers should undertake the responsibility of safe disposal of their own products. Companies can and should adopt waste

minimization techniques, which will make a important reduction in the amount of e-waste generated and thereby lessening the brunt on the environment. Manufacturers of electronic products contains hazardous materials must be responsible for educating customers and the common public concerning to budding hazard to public health and the environment posed by their products.

### 3) *Responsibility of Citizens*

E-waste product should never be disposed with garbage. By donating our used products, schools, non-profit organizations, and low wage families can afford to use equipment that they otherwise could not afford. While buying electronic equipment can check the following conditions

- It have been certified by international standards like energy star, epeat.
- Use recyclable products.
- Check whether the manufacturer has been offer, leasing or take back options.
- Ensure that product is energy efficient
- Products are designed for easy upgrading or disassembly.

## IV. TECHNOLOGIES FOR REDUCING ENVIRONMENTAL IMPACTS

### A. *Refurbishing*

Old electronic equipment and servers can be refurbished to meet new supplies. An old computer and other IT hardware can be complete almost new again by reconditioning and replace their parts. Rather than buying a new computer, refurbished IT hardware bought from the marketplace. Currently more institutions are open to purchasing refurbished goods, and the market for refurbished IT tools is growing.

From the green angle, reusing is a better long-term way of running income. Financially speaking, it is more sensible as outward cash flow and capital expenditures reduced. If these options are inappropriate, the outdated equipment donated to charities or schools or computers trade. Charities refurbish old computers and give them to those in need.

### B. *Recycle*

Reuse of tin, aluminum, iron, silicon, PCB, mother-board, and different variety of plastics – all present in bulk in computers- can reduce the costs of designing a new system. Whole computers and piece of electronic equipment are shredded into smaller pieces to be more convenient and facilitate the parting of the constituent mechanism. Many resources used in the construction of computer hardware can be recovered in the recycling procedure for use in future production. When computers cannot be reused, even after considering the prospects of refurbishing, they must be disposed properly in environmentally friendly ways.

### C. *Blackle*

Blackle is a search-engine site motorized by Google Search. Blackle came into being based on the concept that when a computer display is white, present an empty word or the Google home, your computer consumes 74W. When the screen is black it consumes only 59W. Based on this theory if everyone switched from Google to Blackle, mother earth

would save 750MW each year. It was a really better implementation of Green Computing. The principle behind Blackle is because the display of different colors consumes different amounts of energy on computer monitors.

### D. *Zonbu Compute*

Zonbu was founded by Alain Rossmann[8]. It is a technology corporation that market a computing policy which combines a web-centric service, small form factor and an open source based software architecture The Zonbu is a new, very energy efficient computer. The Zonbu consumes just one third of the power of a typical light bulb. The device runs the Linux operating system using a 1.2 gigahertz processor and 512 meg of RAM. It also contains no moving parts, and does even contain a fan. You can get one for as little as US\$99, but it does require you to sign up for a two-year subscription.

### E. *Sunray Thin Client*

Sun Microsystems is reporting enlarged customer attention in its Sun Ray, a thin desktop client, as electricity prices climb, according to Subodh Bapat, vice president and chief engineer in the Eco Responsibility administrative center at Sun. Thin clients like the Sun Ray guzzle far less electricity than conservative desktops, he said. A Sun Ray on a desktop consumes 4 to 8 watts of power, because a server performs most of the weighty computation. Sun says Sunrays are chiefly well suited for cost-sensitive environments such as call centers, edification, healthcare, service providers, and finance. PCs have more powerful processors as well as hard drives, impressive thin clients don't have. Thus, traditional PCs regularly consume a significantly larger quantity of power. In the United States, desktops need to consume 50 watts or less in idle mode to qualify for new stringent Energy Star certification.

### F. *The Asus EEE Pc & Other Ultra Portables*

The "ultra-portable" class of personal computers is characterized by a small size, fairly low power CPU, compact screen, low cost and innovations such as by means of flash reminiscence for storage rather than hard drives with spinning platters. These factors join to facilitate them to run more efficiently and utilize less power than a standard form factor laptop. The Asus EEE PC is one example of an ultraportable. It is the size of a paperback, weighs less than a kilogram, has built-in Wi-Fi and uses flash memory instead of a hard drive.

## V. CONCLUSION

It can be experiential that green computing is a need of protect our environment. As more and more year passes a need of computer also can augment. There is an alternative way to intend a processor and a system such that we don't increase demands on the environment, but still supply an increased amount of processing capability to customers to satisfy their business needs. Green computing is not about going out and designing eco-friendly packaging for products. Now the time came to think about the proficiently use of computers and the resources which are non-renewable. It opens a new window for the new industrialist for harvest with E-waste material and scrap computers.

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